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ABSTRACT

Reported are the results of a correlational study designed to examine non-cognitive factors which might affect mathematical achievement in junior high school. These factors included student attitudes toward mathematics, student reports of their parents' attitudes toward mathematics, and socio-economic status of the students' families. Each of these factors was correlated with the others and with mathematical achievement. The sample for the study included 150 students selected randomly from the total population of students enrolled in mathematics courses at one junior high school. The questionnaire administered to the students utilized a modified version of the Dutton attitude scale, the Duncan extension of the National Opinion Research Center scales of occupational status, and a short scale designed to measure student reports of their parents' attitudes toward mathematics. The measure of mathematical achievement was the mean of four grade point averages from six-week grading periods and a mid-year examination score. Responses were analyzed for the total group, for subgroups divided by sex, for the total parent group, and for parent subgroups divided by sex. From the analysis it was concluded that student attitudes toward mathematics are directly related to their reports of their parents' attitudes toward mathematics and that student achievement in mathematics is directly related to student attitudes toward mathematics. (RS)

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STUDENT ATTITUDES, PERCEIVED PARENTAL ATTITUDES, AND SOCIO-ECONOMIC STATUS AS PREDICTORS OF JUNIOR HIGH SCHOOL MATHEMATICS ACHIEVEMENT

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Purpose of the study. - This study is an attempt to examine selected non-cognitive factors which may affect achievement in junior high school mathematics.

The problem. - The problematic questions this study dealt with were:

1. Is achievement in junior high school mathematics related to student attitudes towards mathematics?
2. Is achievement in junior high school mathematics related to student reports of parents' attitudes toward mathematics?
3. Is achievement in junior high school mathematics related to the socio-economic status of students' families?
4. Are student attitudes toward mathematics related to student reports of their parents' attitudes towards mathematics?
5. Are student reports of their parents' attitudes toward mathematics related to their parents' socio-economic status?
6. Are student attitudes toward mathematics related to the socio-economic status of the students' families?

Limitations and assumptions of the study. - The researchers claim external validity or generalizability only to the population from which the sample was drawn, although they realize the possibility that similar schools in the same geographic region might display somewhat similar results.[1]

The assumption has been made that the Dutton[2] attitude scale and the instrument designed to measure student reports of parents' attitudes toward mathematics were valid. The

researchers have also assumed that the modifications of the Dutton attitude scale did not significantly affect the original quantification scheme put forward by Dutton.

Importance of and need for the study. - Since attitudes represent values, it would appear reasonable to assume that one's attitudinal structure plays a large part in determining in which activities one chooses to participate and also the extent of constructive participation. If this indeed be the case, then a student's attitude toward a particular subject should to a marked degree determine his interest and effort in the study of that subject.

Attitudes that a student acquires are to a degree influenced by his immediate family. The sociologists claim that a family's socio-economic status is one indication of style of life and value structure. Lewis has stated,

> It is clear to even a casual observer that in most towns or cities there are "good" and "poor" neighborhoods, "across the tracks," "country club sets," "poor but honest folks," "poor white trash," "shanty towns," and the like. It is equally clear that the social order and life in general do not bear in the same way upon the different groups designated by these terms. Clearly, youngsters growing up in these diverse groups build into themselves very different personalities. They do not leave these personalities at home when they come to school.[3]

Accordingly it would seem a student's attitude toward mathematics, his perception of his parents' attitudes toward mathematics, and the socio-economic status of his family

would bear upon his achievement in mathematics. Further, the socio-economic status of the family should to a marked degree determine their attitudes toward education in general and mathematics in particular.

It was felt that if the findings of this study substantiated the hypothesis that achievement in mathematics relates to student attitudes and reported parental attitudes, then other studies could be initiated to determine how to go about changing attitudinal structure and also to evaluate these changes as they affect resultant subject area achievement.

At the time of this study, the researchers were unable to find studies made of the effect of reported perceived parental attitudes toward mathematics on student achievement in mathematics. Likewise, studies dealing with socio-economic status as a factor in student attitudes toward mathematics and their interrelationships to achievement could not be found. This study was considered to be a means to provide some data to help fill in these gaps in the literature.

Hypotheses tested in the study. - The following hypotheses were tested in the study:

1. There exists a significant positive correlation between student attitude toward mathematics and student reports of their parents' attitudes toward mathematics.
2. There exists a significant positive correlation between the student reports of their parents' attitudes toward mathe-

matics and their parents' socio-economic status.

3. There exists a significant positive correlation between student achievement in mathematics and student reports of their parents' attitudes toward mathematics.

4. There exists a significant positive correlation between student achievement in mathematics and student attitudes toward mathematics.

5. There exists a significant positive correlation between socio-economic status of the students' families and student achievement in mathematics.

6. There exists a significant positive correlation between student attitudes toward mathematics and socio-economic status of the students' families.

Source and treatment of data. - This study made use of a questionnaire (see Appendix B) designed to provide an index of student attitudes toward mathematics and to obtain student reports of their parents' attitudes toward mathematics. The questionnaire was administered to one hundred and fifty students at Thomas Jefferson Junior High School located in Miami, Florida. The respondents were randomly selected from the total population of students who were enrolled in mathematics courses at the junior high school. Four levels of mathematics are taught at Thomas Jefferson Junior High School. Students are placed in one of the four levels in accordance with their past achievement in mathematics and their ability in mathematics as demonstrated on

standardized tests. The sample drawn was checked and found to be representative of the four levels of instruction used in the school.

The permanent files were utilized to obtain evidence which was used to determine the occupational status for the family. In this regard,

> sociologists ordinarily have assumed that a valid procedure, in the case of an individual with no unequivocal occupational status of his own, is to classify according to the most pertinent member of his immediate family with whom he lives.[4]

This occupational status of the most pertinent member of each respondent's family was used as an index for the socio-economic status of each respondent and of his family. Duncan's extension of the National Opinion Research Center scales[5] was used to rate the sample with respect to socio-economic status and to quantify the resultant data.

The permanent records also were utilized to determine each respondent's grade point average in mathematics for the elapsed portion of the current year. This period represented one full semester of work and one third of the following semester. These grade point averages in mathematics based upon four six-weeks grading periods and a mid-year examination were averaged and employed as an index of achievement in mathematics.

For the administration of the questionnaire, the students included in the study were assembled in a classroom provided by the school in groups ranging in size from thir-

teen to twenty-two. Directions were read (see Appendix A) to the group aloud while the students read silently. Most respondents indicated that they understood the directions at first reading. For the benefit of a few not understanding, a second reading of the instructions was made and followed by a sample statement and response. The same procedure was used for each respondent group. The time required for the students to complete the questionnaire varied from approximately ten minutes to twenty-five minutes.

Review of the related literature. - Stright[6] indicated that, by the third grade, children have formulated definite attitudes toward arithmetic. Stephens[7] compared the attitudes of high, regular, and low achievers in mathematics using the Dutton attitude scale as a measure of respondent attitudes toward mathematics. A significant difference in mean attitude was found between the accelerated and the remedial groups, and, also, between the accelerated and regular groups. She indicated that the high significance found between the accelerated and regular groups may form a basis for the selection of future accelerated groups. Bassham, Murph[illegible], and Murphy[8] found that by holding mental ability and reading comprehension constant, the relationship between the classifications of under and over achievers and attitudes toward mathematics as measured by the Dutton attitude scale was significant. Lyda and Morse in their study of low level

achievers in arithmetic indicate that

> Associated with meaningful methods of teaching arithmetic and change in attitude are significant gains in arithmetic achievement.[9]

Abrego in her study of elementary students' attitudes toward mathematics hypothesized that "students who achieve in mathematics have a positive attitude toward mathematics."[10]

Fedon[11] used the Dutton attitude scale to access his respondents' attitudes toward arithmetic. His respondents were instructed to respond to each statement with a color choice. The respondents had previously ranked the colors from best liked to least liked. Each respondent was thereby able to indicate degree of agreement or disagreement for each statement. Using the scale in this manner constitutes a major modification of the traditional application of the scale.

Development of the study instruments. - The instruments used in this study include the Dutton attitude scale, the Duncan extension of the National Opinion Research Center Scales and a scale developed by the researcher to assess student reports of their parents' attitudes toward mathematics. The Duncan scale was left unchanged. The Dutton attitude scale was modified as described below. The short scale developed by the researchers was quantified by the researchers at the University of Florida, College of Education personnel in a way consistent with Dutton's quantification scheme.

Dutton attitude scale. - Dutton's attitude scale is a

scale designed to measure student and teacher attitudes toward arithmetic[12] (see Appendix C). With the advent of the "modern" mathematics, the term "arithmetic" in the junior high school curriculum has largely been replaced by the term "mathematics." This is the case in the school where the study was carried out. As such, the word "mathematics" replaced "arithmetic" in the scale wherever the latter appeared. Traditionally, the respondent, in taking Dutton's scale, has been asked to check those statements that he agreed with and to not mark at all those that he disagreed with. In this study the respondent was asked to respond to each statement by circling one of four symbols that best represented his position or attitude on each statement. The possibilities were "SA" for strongly agree, "A" for agree, "D" for disagree, and "SD" for strongly disagree. This variation was used based upon Fedon's success with his modifications and also due to the recognized possibility that junior high school students would not read each statement carefully if a specific response was not called for. Dutton's original quantification scheme ranged from 10.4 to 1.0 indicating varying degrees of favorable to unfavorable attitudes toward mathematics. The respondent's overall score was determined by taking the mean of his individual response scores. The mean item score of 5.7 was taken to represent a neutral attitude toward mathematics. In this study, if a respondent agreed with a statement, he was given the original Dutton score on that statement. If he strongly agreed to a statement whose original Dutton quanti-

fication value was 5.7 or less, then .5 was subtracted from the original value and this resultant value was given to the respondent on that statement. If the respondent strongly agreed to a statement whose original Dutton quantification value was greater than 5.7, then .5 was added to the original value and this resultant value was given to the respondent on that statement. If a respondent strongly agreed to a statement that indicated a positive attitude toward mathematics, i.e., one whose original quantification value was greater than 5.7, then it was reasoned that his score on that item should be incremented indicating a more positive attitude than the "agree" response. Similarly, if he strongly agreed to a statement that indicated a negative attitude toward mathematics, i.e., one whose original quantification value was 5.7 or less, then it was reasoned that his score on that item should be decremented indicating a more negative attitude than the "agree" response. Each respondent's mean index of mathematical attitude was calculated by adding all scored responses and dividing that sum by the number of scored responses.

Dutton's scale has appeared frequently in the literature as both a student and a teacher index of mathematical attitude.

Contradictions were found in some responses to the Dutton attitude scale. Some students responded with choices to the individual statements that were clearly incompatible with other choices. After much reflection, the researchers decided not to endeavour to eliminate those responses which were not

compatible with the remainder of the responses for the individual. The elimination of certain responses would have introduced uncontrollable bias which should be avoided.

Instrument used to measure student perceptual reports of their parents' attitudes toward mathematics. - This short instrument designed by the researchers dealt with the student's feelings about their parents' attitudes toward mathematics. The respondents were instructed to respond to each statement or complete with the multiple choice word or phrase that best typified the students' parents' attitudes as well as the students' feelings about their parents' attitudes toward mathematics. The remaining questions dealt with the respondent's parents' views of the respondent's progress in mathematics and the degree of willingness the respondent's parents showed in helping their child with his mathematics homework. These aspects of parental involvement and concern were not hypothesized. However, the researchers felt that they were relevant to the problem of low achievement in mathematics. Each of the statements in this short scale were asked for each parent separately.

Analysis and Discussion of Data. - The analysis of the obtained data relied upon testing a set of null hypotheses generated for each of the originally stated positive hypotheses. The respondent group was analyzed (1) as a total group, and (2) as two sub groups, males and females. The student reports of their parents' attitudes toward mathematics were analyzed

for (a) the total parent group, and (b) for two subgroups, mothers and fathers. Hence, null hypotheses were generated for each of the six original hypotheses.

The statistical analysis of the generated group null hypotheses. - The Pearson product-moment coefficient of correlation was calculated for each pair of variables in the group null hypotheses. Fisher's transformation was computed for each of the resultant correlations. Each transformed value was compared to the zero order correlation using the "z" test with $\sigma' = 1/\sqrt{n-3}$.[13] The following correlations, as may be seen in Tables One, Two, and Three, were found to significantly differ from zero at the .01 level; student attitudes toward mathematics and student reports of their mothers' attitudes toward mathematics for the entire respondent group, student attitudes toward mathematics and student reports of their fathers' attitudes toward mathematics for the entire respondent group, student attitudes toward mathematics and student reports of their combined parental attitudes toward mathematics for the entire respondent group, student attitudes toward mathematics and student achievement in mathematics for the male respondents, student attitudes toward mathematics and student reports of their combined parental attitudes toward mathematics for the male respondents, student attitudes toward mathematics and student reports of their mothers' attitudes toward mathematics for the female respondents, student attitudes toward mathematics and student reports of their

fathers' attitudes toward mathematics for the famale respondents, student attitudes toward mathematics and student reports of their combined parental attitudes toward mathematics for the female respondents. The following correlations were found to significantly differ from zero at the .05 level; student achievement in mathematics and student attitudes toward mathematics for the entire respondent group, student achievement in mathematics and student reports of their fathers' attitudes toward mathematics for the male respondents, student attitudes toward mathematics and student reports of their mothers' attitudes toward mathematics for the male respondents, student attitudes toward mathematics and student reports of their fathers' attitudes toward mathematics for the male respondents.

Of the nine null hypotheses generated for the first original hypothesis, all were rejected. Of the nine null hypotheses generated for the second original hypothesis, none were rejected. Of the nine null hypotheses generated for the third original hypothesis, the one dealing with student achievement in mathematics and student reports of their fathers' attitudes toward mathematics for the male respondents was the only one rejected. Of the three null hypotheses generated for the fourth original hypothesis, the one dealing with student attitudes toward mathematics and student achievement in mathematics for the male respondent group and the one dealing with student attitudes toward mathematics and student

achievement in mathematics for the entire respondent group were rejected. None of the null hypotheses generated for the fifth and sixth original hypotheses were rejected.

Each correlation that was found to differ significantly from zero for the male respondents was checked against the corresponding one for the female respondents. The same procedure was used for the correlations obtained for the female respondents. Fisher's transformed values were again utilized in the "z" test with $\sigma=1/\sqrt{(n_1 3)+(n_2-3)}$.[14] The resultant "z" values indicated that the significant correlations obtained for the females did not differ significantly from those correlations obtained for the males. Similarly, the significant correlations obtained for the males did not differ significantly from those correlations obtained for the females. Tables of all resultant correlations appear on the following pages.

TABLE ONE

Pearson Product-Moment Coefficients of Correlation for the Entire Respondent Group
N=150

	1	2	3	4	5	6
1		.031	.188*	-.003	.090	.055
2			.121	.023	.138	.101
3				.393**	.300**	.421**
4					.340	----
5						----
6						

* $p<.05$

** $p<.01$

Variable:

1. Student achievement in mathematics
2. Socio-economic status of students' families
3. Student attitudes toward mathematics
4. Student reports of mothers' attitudes toward mathematics
5. Student reports of fathers' attitudes toward mathematics
6. Student reports of combined parental attitudes toward mathematics

TABLE TWO

Pearson Product-Moment Coefficients of Correlation for the Male Respondent Group
N=77

	1	2	3	4	5	6
1		.140	.319**	.108	.236*	.220
2			.160	-.074	.107	.035
3				.242*	.236*	.290**
4					-.339	----
5						----
6						

*p <.05
**p <.01

Variable:

1. Student achievement in mathematics
2. Socio-economic status of students' families
3. Student attitudes toward mathematics
4. Student reports of mothers' attitudes toward mathematics
5. Student reports of fathers' attitudes toward mathematics
6. Student reports of combined parental attitudes toward mathematics

TABLE THREE

Pearson Product-Moment Coefficients of Correlation for the Female Respondent Group N=73

	1	2	3	4	5	6
1		-.080	.080	-.087	-.119	-.124
2			.051	.071	.179	.149
3				.485**	.376**	.525**
4					----	----
5						----
6						

*p <.05
**p <.01

Variable:

1. Student achievement in mathematics
2. Socio-economic status of students' families
3. Student attitudes toward mathematics
4. Student reports of mothers' attitudes toward mathematics
5. Student reports of fathers' attitudes toward mathematics
6. Student reports of combined parental attitudes toward mathematics

Summary. - This study dealt with factors which might impinge upon achievement in junior high school mathematics. A sample was randomly drawn from the mathematics students of Thomas Jefferson Junior High School located in Miami, Florida. The factors taken under consideration in this study included student attitudes toward mathematics, student reports of their parents' attitudes toward mathematics, ~~student reports of their parents' attitudes toward mathematics,~~ and socio-economic status of the students' families. Each of these was correlated with one another and with mathematics achievement. The hypothesis dealing with the existence of a direct relationship between student attitudes toward mathematics and student reports of their parents' attitudes toward mathematics was substantiated. The hypothesis dealing with the direct relationship between student attitudes toward mathematics and student achievement in mathematics was substantiated. The remaining four hypotheses dealing with the direct relationship existing between achievement in mathematics and socio-economic status, attitudes toward mathematics and socio-economic status, student reports of their parents' attitudes toward mathematics and socio-economic status, student reports of their parents' attitudes toward mathematics and achievement in mathematics were not substantiated.

This study utilized a modified version of the Dutton attitude scale, the Duncan extension of the National Opinion Research Center scales of occupational status, and a short

scale designed to measure student reports of their parents' attitudes toward mathematics.

Conclusions. - It was concluded in this study that student attitudes toward mathematics are directly related to their reports of their parents' attitudes toward mathematics and that student achievement in mathematics is directly related to student attitudes toward mathematics. It was also concluded that: student reports of their parents' attitudes toward mathematics are not related to the socio-economic status of their parents, student achievement in mathematics is not related to student reports of their parents' attitudes toward mathematics, student achievement in mathematics is not related to socio-economic status of the students' families, and student attitudes toward mathematics are not related to socio-economic status of the students' families.

Since student attitudes were found to be directly related to student reports of their parents' attitudes toward mathematics and also that student attitudes were found directly related to student achievement in mathematics, then it should deductively follow that student achievement in mathematics be directly related to the student reports of their parents' attitudes toward mathematics. This, however, was not the case and therefore necessitates other similar studies to reconcile the somewhat contradictory results.

It should be noted that even though some of the hypothesized correlation coefficients were found to differ positively

from zero, the coefficient of determination for the highest of the significant correlations indicated that only twenty-eight percent of the variability in one variable could be attributed to variability in the other. The other significant correlations yielded even lower coefficients of determination.

Some theoretical considerations. - In that the data of this study indicate that reported parental attitudes were related to student attitudes toward mathematics and that student attitudes were related to achievement in mathematics, it would seem reasonable to assume that further studies should be carried out to identify some ways of changing attitudinal structure on the parts of both students and parents. The "change agent" should keep in mind that individuals have a "latitude of acceptance" for positions close to their own.[15] The "change agent" should measure his success in small increments and be willing to shift an individual's attitude to a new position within that individual's latitude of acceptance. This then should create a modified attitude with a newly defined latitude of acceptance. Over time, through repeated shifts, the position or attitude might be shifted to a location for outside of the individual's original latitude of acceptance.

This incrementation within the recipient's latitude of acceptance does much to insure against his alienation which could easily militate against future shifts of position. Upon alienation, the recipient most probably would tend to defend his own position much more strongly than he would have if alienation

toward the "change agent" had not occurred. In light of this, it would seem wise for a change agent to proceed with caution and avoid the condition of alienation. To precociously suggest a new position to an unwilling person may cause him to cling to his original position with a new tenacity.

APPENDIX A

Instructions to student:

You have been selected to participate in a study designed to measure junior high school students' attitudes toward mathematics. Your individual results will not be available to your classroom teachers or recorded on your permanent files. No teacher, counselor, nor administrator of this school will have access to your individual test results.

Circle one symbol to the left of each of the first 22 statements on the following pages. If you strongly agree with the statement, circle "SA." If you agree with a statement, but not strongly, circle "A." If you disagree, circle "D," and if you strongly disagree, circle "SD." Circle one symbol at the left of each statement that best fits your attitude or position on the statement. Do not skip any statements and respond to each to the best of your ability. Below is a sample statement and response:

SA A D (SD) I wish school lasted all year instead of only nine months.

The student strongly disagreed and circled "SD."

For the remaining statements, choose the completion that best typifies your parents' attitude toward math and your feelings about their attitudes.

Turn the page and start.

APPENDIX B

SA - Strongly Agree
A - Agree
D - Disagree
SD - Strongly Disagree

SA A D SD 1. I think about mathematics problems outside school and like to work them out.

SA A D SD 2. I don't feel sure of myself in mathematics.

SA A D SD 3. I enjoy seeing how rapidly and accurately I can work mathematics.

SA A D SD 4. I like mathematics, but I like other subjects just as well.

SA A D SD 5. I like mathematics because it is practical.

SA A D SD 6. I don't think mathematics is fun, but I always want to do well in it.

SA A D SD 7. I am not enthusiastic about mathematics, but I have no real dislike for it either.

SA A D SD 8. Mathematics is as important as any other subject.

SA A D SD 9. Mathematics is something you have to do even though it is not enjoyable.

SA A D SD 10. Sometimes I enjoy the challenge presented by a mathematics problem.

SA A D SD 11. I have always been afraid of mathematics.

SA A D SD 12. I would like to spend more time in school working mathematics.

SA A D SD 13. I detest mathematics and avoid using it at all times.

SA A D SD 14. I enjoy doing problems when I know how to work them well.

SA A D SD 15. I avoid mathematics because I am not very good with figures.

SA A D SD 16. Mathematics thrills me, and I like it better than any other subject.

SA A D SD 17. I never get tired of working with numbers.

SA A D SD 18. I am afraid of doing word problems.

SA A D SD 19. Mathematics is very interesting.

SA A D SD 20. I have never liked mathematics.

SA A D SD 21. I think mathematics is the most enjoyable subject I have ever taken.

SA A D SD 22. I can't see much value in mathematics.

Answer questions 1 through 10. Circle the letter which you feel best typifies your parents' attitudes and your feelings about their attitudes.

1. My mother has tried to help me with my mathematics homework:
   A. Many times
   B. Few times
   C. Never or almost never

2. My father has tried to help me with my mathematics homework:
   A. Many times
   B. Few times
   C. Never or almost never

3. My mother
   A. Greatly likes mathematics
   B. Likes mathematics
   C. Neither likes nor dislikes mathematics
   D. Dislikes mathematics
   E. Greatly dislikes mathematics

4. My father
   A. Greatly likes mathematics
   B. Likes mathematics
   C. Neither likes nor dislikes mathematics
   D. Dislikes mathematics
   E. Greatly dislikes mathematics

5. When my mother discusses mathematics with me it is generally
   A. A pleasant conversation
   B. Neither a pleasant nor an unpleasant conversation
   C. An unpleasant conversation

6. When my father discusses mathematics with me it is generally
   A. A pleasant conversation
   B. Neither a pleasant nor an unpleasant conversation
   C. An unpleasant conversation

7. What word best describes your mother's feelings about your progress in mathematics?
   A. Overjoyed
   B. Satisfied
   C. Unhappy
   D. Very dissatisfied
   E. Doesn't care

8. What word or phrase best describes your father's feelings about your progress in mathematics?
   A. Overjoyed
   B. Satisfied
   C. Unhappy
   D. Very dissatisfied
   E. Doesn't care

9. Rate how you feel each of your parents feel toward mathematics. Give them a value of 5 if you feel they really like mathematics, a 0 if you feel they really dislike mathematics. Give them a value in between if you feel they don't really like or dislike it. A 3 represents a neutral value.

   Circle One
   Mother 1 2 3 4 5

   Circle One
   Father 1 2 3 4 5

10. My mother has expressed to me
    A. She liked mathematics when in school and had no difficulty with it.
    B. She liked mathematics when in school but had some difficulty with it.

C. She disliked mathematics when in school but had no difficulty with it.

D. She disliked mathematics when in school and had difficulty with it.

E. She hated it.

11. My father has expressed to me

A. He liked mathematics when in school and had no difficulty with it.

B. He liked mathematics when in school but had some difficulty with it.

C. He disliked mathematics when in school but had no difficulty with it.

D. He disliked mathematics when in school and had difficulty with it.

E. He hated it.

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